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ORIGINAL ARTICLE

The Amsterdam Hip Protector Study: compliance and determinants of compliance

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Abstract Hip protectors appear to be effective in reducing the incidence of hip fractures. However, compliance is often poor. Therefore, the objective of this study was to examine the compliance and determinants of compliance with external hip protectors. A prospective study was performed in residents from apartment houses for the elderly, homes for the elderly and nursing homes with a high risk for hip fracture ($n = 276$). The study was performed within the framework of the Amsterdam Hip Protector Study, a randomized controlled trial examining the effect of external hip protectors on the incidence of hip fractures. Compliance was assessed by unannounced visits at 1, 6 and 12 months after inclusion in the study. During the visits, a member of the research team checked whether the participant was wearing the hip protector and, if so, whether it was worn correctly. Furthermore, data on potential determinants of compliance were collected by interviewing the participants or their nurses. Compliance was 60.8% after 1 month ($n = 217$), 44.7% after 6 months ($n = 246$), and 37.0% after 12 months ($n = 230$). Of those wearing the hip protector, 86.7%, 91.7% and 96.5% of the participants were wearing the hip protector correctly after 1, 6 and 12 months respectively; and 14.8%, 16.1% and 8.8% respectively reported wearing the hip protector at night. Compliance after 12 months was predicted by the compliance after 1 month (RR = 2.04; 90% CI: 1.05–3.96). Furthermore, people who experienced one or more falls in the half year before baseline had a lower probability of being compliant at 6 months (RR = 0.72; 90% CI: 0.52–0.99). In conclusion, compliance is a very important issue in hip protector research and implementation. Although, the compliance percentages were moderately high during the unannounced visits in this study, not everyone was wearing the protector correctly and most participants did not wear the hip protector during the night.

Keywords Compliance · Determinants · Elderly · Hip fracture · Hip protector

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Introduction

The incidence of hip fractures is increasing rapidly. This is caused not only by the rising number of elderly people but also by an increase of the age-adjusted incidence [1, 2, 3, 4, 5]. Hip fractures are associated with high morbidity and mortality [6, 7, 8]. Furthermore, the socioeconomic impact of hip fractures is high due to the costs of hospital admission and rehabilitation [6, 9].

The external hip protector is a promising device in the prevention of hip fractures [10]. There are two types of hip protectors: the energy-shunting and the energy-absorbing type. When a person falls on the hip, the hip protector will shunt away the energy towards the soft tissues and /or the protector will absorb part of the energy [11].

Non-compliance is one of the major problems concerning the use of external hip protectors. In five out of eight randomized controlled trials examining the effectiveness of external hip protectors that were identified in the literature, compliance with wearing hip protectors was lower or equal to 50% [11, 12, 13, 14, 15, 16, 17,18]. The method of measuring and calculating compliance, e.g. use during the daytime or also at night, was often not clearly described. Furthermore, although casual observations regarding the determinants of compliance were made in most studies, there was only one trial in which statistical tests were performed to analyze the

determinants of compliance [18]. In this study, significantly more drop-outs than wearers experienced the hip protectors as uncomfortable and unattractive; and fewer drop-outs thought the hip protector was useful.

The present study was performed within the framework of a large randomized controlled trial in which the effectiveness of the hip protector is examined: the Amsterdam Hip Protector Study. In this study, a member of the research team performed unannounced visits to all hip protector participants at 1, 6 and 12 months after inclusion in the study. To our knowledge, this is the first study in which it was checked whether the participant was wearing the hip protector correctly, i.e. undamaged protectors, which are placed over the greater trochanter. Furthermore, this is one of the first large studies in which the determinants of compliance were investigated systematically.

The objectives of our study were (1) to assess compliance with hip protectors at 1, 6 and 12 months after inclusion in the Amsterdam Hip Protector Study, and (2) to assess the determinants of compliance.

Methods

Subjects

The present study is part of the Amsterdam Hip Protector Study. The subjects included are elderly persons aged 70 years and over who are living in apartment houses for the elderly, homes for the elderly or nursing homes, in Amsterdam and its surroundings (The Netherlands). Educational meetings were organized in all homes to recruit participants for the study. In potential participants, an ultrasound measurement (broadband ultrasound attenuation) of the calcaneus was performed and risk factors for falls were assessed to determine the risk for hip fracture. The following risk factors for falls were assessed: (A) one or more falls during the previous half year, (B) dizziness while standing up from a chair in the previous two weeks, (C) stroke with lasting consequences, (D) low physical activity (defined as "not walking, cycling or performing heavy household tasks in the last two weeks"), (E) urinary incontinence, (F) impaired mobility (assessed by the walking observation scale [19]), and (G) cognitive impairment (defined as "living on a psychogeriatric ward or Mini-Mental State Examination < 24" [20]). Persons were included in the randomized controlled trial when they fulfilled the following criteria: (1) broadband ultrasound attenuation (BUA) ≤ 40 dB/MHz, or (2) $40 <$ BUA ≤ 60 dB/MHz and at least two risk factors for falls, or (3) $60 <$ BUA ≤ 70 dB/MHz and at least three risk factors for falls. All persons with a high risk for hip fracture were assigned to either the intervention group ($n = 276$) or control group ($n = 285$) by individual randomization. In the intervention group, hip protectors of the energy-shunting type (Safehip) and a brochure containing information on bone health (e.g. diet, sunshine exposure) and external risk factors for falls (e.g. loose carpets) were given; in the control group only the brochure was given. The Ethical Review Board of the VU University Medical Center gave their approval for this study, and all respondents (or their proxies) gave informed consent.

Measurements

Compliance was assessed in all persons assigned to the hip protector group by unannounced visits at 1, 6 and 12 months after inclusion in the study. Because the final protocol regarding the compliance measurements was made when the trial already had been started, and 42 participants had already been wearing hip protectors for more than three months at that point of time, the compliance measurement after 1 month could not be performed for these participants. During the unannounced visits, a member of the research team checked whether the participant was wearing the hip protector and whether the protector was used correctly, i.e. undamaged protectors which were placed over the greater trochanter. Furthermore, the participant (or the nurse in the case of psychogeriatric patients and other patients who could not be interviewed) was interviewed to check whether the participant was wearing the hip protector during the night and to assess the determinants of compliance (determinants are described below). When a participant was not at home after several attempts to visit him or her, he/she was visited another day. If the participant was still not at home, a ward nurse was asked for the reason of absence.

The following baseline variables were longitudinally examined as potential determinants of compliance: age, gender, type of institution, and the risk factors for falls. Furthermore, an assessment was made whether compliance at 6 and 12 months could be predicted by the compliance at previous measurements.

Finally, potential determinants of compliance, which were assessed during the compliance visits, were examined cross-sectionally: (1) wearing the hip protector as underwear versus wearing the hip protector in combination with underpants, (2) using urinary incontinence material, (3) having a sufficient number of hip protectors (shortage can be a result of all hip protectors being washed at the same time), (4) experiencing the hip protector as comfortable, (5) difficulty taking the hip protector on and off, (6) completely depending on nursing staff, (7) the hip protector being visible to others, and (8) fear of falls.

Statistical methodology

Compliance was calculated by dividing the number of persons who were wearing the hip protector by the total number of persons in the hip protector group. Two different calculations of compliance were made. In both calculations, persons who died and other persons with missing data for that time point were excluded. In the first calculation, persons who were not visited because they stopped wearing hip protectors before the compliance measurement were added to the "non-compliers" group. In the second calculation, all persons who stopped wearing hip protectors before the compliance measurement were excluded.

Before analyzing the determinants of compliance, "difficulty taking the hip protector on and off ", "hip protector visible to others" and "fear of falls" were split into "yes" (yes or a little) versus "no". Furthermore, "experiencing the hip protector as comfortable" was split into "comfortable" (good or reasonable comfort) versus "not comfortable" (moderate or bad comfort). To analyze the determinants of compliance, crosstabs were used to calculate the risk ratio in univariate analyses; in multivariate analyses, Cox regression with equal survival time for all subjects was used. All variables that were statistically significant in univariate analyses were entered into the multivariate model. Variables of which the number of missing values exceeded 20% were excluded. Furthermore, when two variables showed a high Spearman correlation ($r > 0.5$), only the easier measurable variable was put into the model. All variables were entered into the model at the same time.

Results

Compliance

The compliance study was performed for all persons who were randomized to the hip protector group ($n = 276$). Of these, 144 (52.2%) were nursing home

Table 1 Baseline characteristics of the hip protector group ($n = 276$)

Baseline characteristics	Mean (SD) /frequencies
Age, mean (SD)	84.8 (6.2)
Female (%)	87.7%
Nursing home (%)	52.2%
One or more falls in the past (%)	51.8%
Dizziness (%) *	44.8%
Stroke with consequences (%)	10.5%
Low physical activity (%)	65.6%
Urinary incontinence (%)	71.7%
Impaired mobility (%)	71.7%
Cognitive impairment (%)	78.2%

*Dizziness was only assessed in persons without a cognitive impairment ($n = 116$).

residents. The mean age was 84.8 years, and 87.7% were female. Other baseline characteristics are presented in Table 1.

The compliance results are presented in Fig. 1. Within 1 month from baseline, 14 persons of the hip protector group died. These persons were excluded from the analysis. Furthermore, 45 persons were not visited (see Methods section and Fig. 1). Compliance after 1 month was 60.8% ($n = 217$). When excluding those individuals who stopped wearing hip protectors before the first compliance measurement, compliance was 76.7% ($n = 172$). Of the 183 persons who were wearing the hip protector at the beginning of the study, 27 (14.8%) reported wearing the hip protector also at night. One hundred and eleven out of 128 persons (86.7%) were correctly wearing the hip protector. The others were wearing the underpants backwards or had protectors which were damaged, probably due to incorrect washing.

Six months after inclusion in the study, 110 out of 246 participants were compliant (44.7%). When excluding those who stopped wearing hip protectors before the first and second compliance measurement, compliance was 70.5% ($n = 156$). Twenty-seven out of 168 persons (16.1%) were wearing the hip protectors also at night;

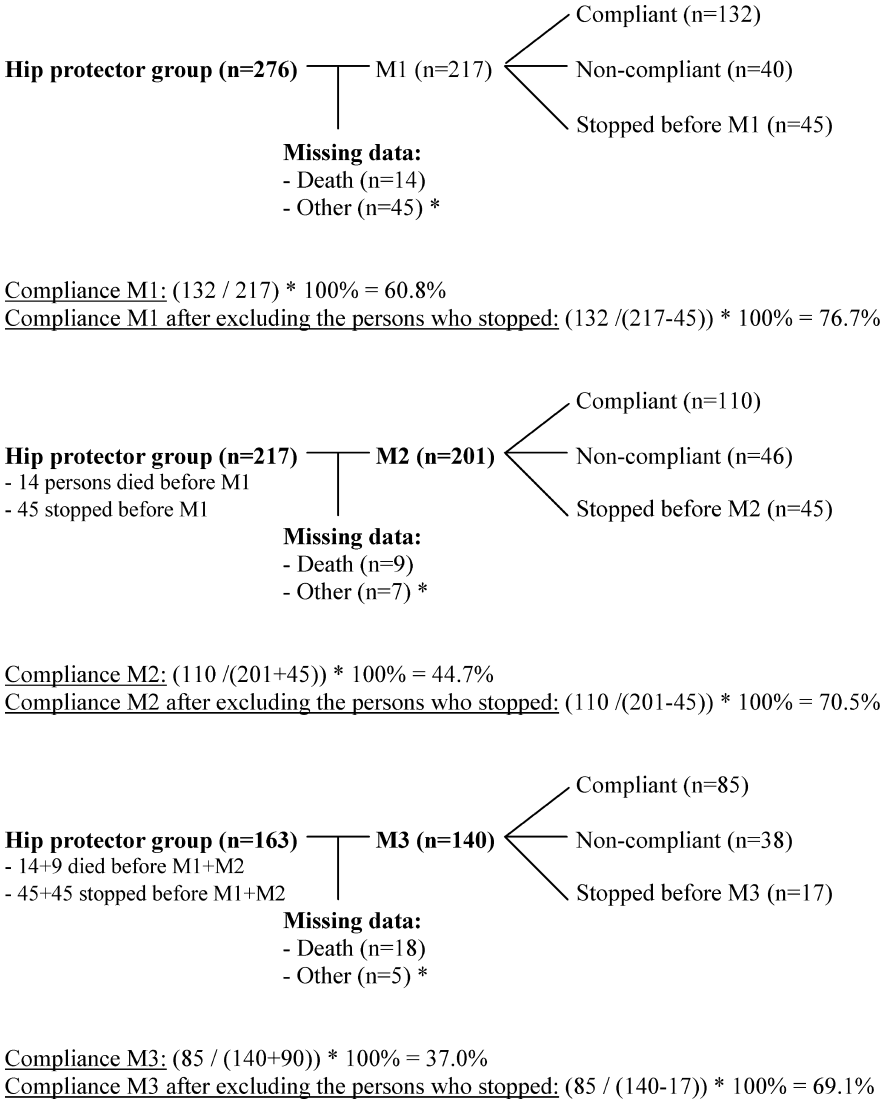

Fig. 1 Compliance with wearing hip protectors. *M1* = compliance measurement at 1 month. *M2* = compliance measurement at 6 months. *M3* = compliance measurement at 12 months after inclusion in the study. *Missing data M1*: not visited ($n = 42$); not at home ($n = 1$); temporarily stopping because of inability to handle the hip protector independently ($n = 1$); not started yet because of wrist fracture ($n = 1$). *Missing data M2*: not at home ($n = 1$); moved to another home that was not yet instructed about the study ($n = 1$). *Missing data M2 and M3*: moved to a home that did not want to participate ($n = 1$); total hip prosthesis or hip fracture on both sides ($n = 2$); nursing staff inaccurately reported that participant stopped wearing hip protectors ($n = 1$); temporary admission to a nursing home ($n = 1$)

Table 2 Univariate, longitudinal analyses of the determinants of compliance at one, six and twelve months after inclusion in the study

Determinants of compliance	Risk ratio (95% CI) for compliance at 1 month ($n = 217$)	Risk ratio (95% CI) for compliance at 6 months ($n = 201$)	Risk ratio (95% CI) for compliance at 12 months ($n = 140$)
Age, per 5 years increase †	0.95 (0.76–1.19)	0.83 (0.66–1.03)	1.03 (0.79 −1.35)
Female vs. male	0.90 (0.67–1.20)	0.94 (0.66–1.34)	1.25 (0.79–1.98)
Nursing home vs. home or apartment house for the elderly	1.32 (1.04–1.67) *	1.39 (1.06–1.82) *	0.89 (0.68–1.16)
One or more falls in the past vs. no falls	0.98 (0.79–1.22)	0.74 (0.57–0.96) *	1.02 (0.78–1.34)
Dizziness vs. no dizziness ‡	0.79 (0.47–1.33)	0.59 (0.35–1.02)	0.78 (0.48–1.27)
Stroke with consequences vs. no stroke with consequences	0.82 (0.51–1.31)	0.51 (0.22–1.17)	0.83 (0.37–1.87)
Low physical activity vs. normal physical activity	0.93 (0.75–1.15)	0.88 (0.68–1.13)	0.66 (0.52–0.86) *
Urinary incontinence vs. no urinary incontinence	1.42 (1.06–1.90) *	1.46 (1.04–2.05) *	1.44 (1.00–2.07)
Impaired mobility vs. no impaired mobility	1.15 (0.89–1.49)	1.31 (0.95–1.80)	0.91 (0.69–1.20)
Cognitive impairment vs. no cognitive impairment	1.67 (1.14–2.46) *	1.68 (1.07–2.65) *	1.00 (0.70–1.43)
Being compliant at compliance measurement one vs. not	–	1.77 (1.15–2.74) *	2.52 (1.33–4.78) *
Being compliant at compliance measurement two vs. not	–	–	2.14 (1.37–3.32) *

* Statistically significant at $p < 0.05$; †Because age is a continuous variable and linearly related to compliance, the odds ratio was presented; ‡ Dizziness was only assessed in persons without a cognitive impairment ($n = 75$ at measurement 1; $n = 79$ at measurement 2; $n = 50$ at measurement 3)

100 out of 109 persons (91.7%) were correctly wearing the hip protectors.

Twelve months after inclusion in the study, 85 out of 230 persons (37.0%) were compliant. When excluding those who stopped before the first, second and third compliance measurement, 69.1% of the participants were compliant ($n = 123$). Eleven out of 125 persons (8.8%) were wearing the hip protector at night and 82 out of 85 persons (96.5%) were correctly wearing the hip protector.

Determinants of compliance

In Tables 2 and 3, the determinants of compliance at 1, 6 and 12 months after inclusion in the study are presented. After 1 month, those most likely to be compliant were: elderly persons who were living in a nursing home, persons who were incontinent for urine (and persons using incontinence material), persons with cognitive impairment, persons who experienced the hip protector as comfortable, and persons who were completely depending on the nursing staff. After 6 months, the same determinants, except for ''completely depending on the nursing staff'', were significantly related to a higher compliance; and persons who had experienced one or more falls in the past were less likely to be compliant. After 12 months, persons with low physical activity were less likely to be compliant. Furthermore, persons who were compliant at previous compliance measurement(s) were more likely to be compliant after 6 and 12 months.

All variables that were significantly related to the compliance after 1 month were entered into a multivariate model. ''Cognitive impairment'' and ''completely depending on the nursing staff'' were not put into the model because of their high correlation with ''type of institution'' ($r > 0.5$); ''urinary incontinence'' was not put into the model because of the high correlation with ''using urinary incontinence material'' ($r > 0.5$). The final model included the following varia2bles: type of institution (RR = 1.02; 90% CI: 0.74–1.39), using urinary incontinence material (RR = 1.39; 90% CI: 0.90–2.15), and experiencing the hip protector as comfortable (RR = 1.63; 90% CI: 0.96–2.75).

To predict compliance after 6 months, all statistically significant variables were entered into the model, except for ''experiencing the hip protector as comfortable'' and ''being compliant at the first compliance measurement'', which were excluded because of too many missing values, and ''cognitive impairment'' and ''being incontinent for urine'', which were excluded because of a high correlation with ''type of institution'' and ''using urinary incontinence material'' respectively ($r > 0.5$). The final model included: type of institution (RR = 1.04; 90% CI: 0.75–1.46), one or more falls in the past (RR = 0.72; 90% CI: 0.52–0.99), and using urinary incontinence material (RR = 1.59; 90% CI: 1.00–2.53).

To predict compliance after 12 months, all variables that were statistically significant in univariate analyses were entered into the model. None of the variables had too many missing values or a correlation of $r > 0.5$. Therefore, the final model included: low physical activity (RR = 0.71; 90% CI: 0.48–1.05), being compliant at the first compliance measurement (RR = 2.04; 90% CI: 1.05–3.96), and being compliant at the second compliance measurement (RR = 1.68; 90% CI: 1.00–2.82).

Discussion

Compliance in the Amsterdam Hip Protector Study was 60.8% at 1 month, 44.7% at 6 months and 37.0% at 12 months after inclusion in the study. These compliance results are comparable with the compliance results from other studies. In five out of eight randomized controlled trials that were identified in the literature, compliance was equal to or below 50% [11, 12, 13, 14, 15, 16, 17,18].

Table 3 Univariate, cross-sectional analyses of the determinants of compliance at one, six and twelve months after inclusion in the study

Determinants of compliance	Frequencies at 1 month (total *n*)	Risk ratio (95% CI) for compliance at 1 month	Frequencies at 6 months (total *n*)	Risk ratio (95% CI) for compliance at 6 months	Frequencies at 12 months (total *n*)	Risk ratio (95% CI) for compliance at 12 months
Only wearing HP (%) vs. combination with own underpants	48% (n = 180)	1.20 (1.00–1.44)	42% (n = 168)	0.91 (0.73–1.14)	32% (n = 125)	0.99 (0.76–1.28)
Using incontinence material (%) vs. not	80% (n = 183)	1.54 (1.10–2.16) *	80% (n = 168)	1.61 (1.08–2.38) *	82% (n = 125)	1.14 (0.80–1.63)
Sufficient number of HP (%) vs. not	74% (n = 173)	1.15 (0.91–1.44)	77% (n = 166)	1.03 (0.79–1.35)	83% (n = 117)	1.42 (0.90–2.25)
Comfortable (%) vs. not	86% (n = 179)	1.73 (1.10–2.71) *	90% (n = 159)	2.24 (1.07–4.67) *	97% (n = 113)	†
Difficulty taking the HP on and off (%) vs. not	45% (n = 88)	0.81 (0.59–1.12)	35% (n = 63)	1.04 (0.70–1.56)	33% (n = 45)	0.76 (0.45–1.29)
Completely depending on nursing staff (%) vs. not	51% (n = 181)	1.23 (1.02–1.48) *	62% (n = 166)	1.10 (0.87–1.39)	64% (n = 125)	1.09 (0.84–1.41)
HP visible to others (%) vs. not	11% (n = 45)	0.62 (0.21–1.85)	13% (n = 45)	1.13 (0.61–2.11)	15% (n = 34)	0.87 (0.41–1.85)
Fear of falls (%) vs. not	63% (n = 49)	1.04 (0.63–1.74)	63% (n = 46)	1.11 (0.69–1.80)	69% (n = 36)	0.93 (0.60–1.47)

HP hip protector(s).* Statistically significant at $p < 0.05$; † Risk ratio could not be calculated due to a zero in one of the cells

Compliance was also calculated after exclusion of those persons who stopped wearing hip protectors before the compliance measurement. In contrast with the first compliance calculation, in the latter only persons who received an unannounced visit to assess the compliance were included in the calculation. This resulted in a compliance of 76.7% after 1 month, 70.5% after 6 months, and 69.1% after 12 months. Because the persons who stopped before the measurements have been excluded, the group becomes smaller during the study period. This results in a higher compliance percentage, and indicates how many people continued to wear the hip protectors.

For hip protectors to be effective in preventing hip fractures, it is not only important that they are worn every day, but also that they are worn 24 hours a day. Most other randomized controlled trials did not report whether the participants were wearing the hip protector during the night. In our study, only a minority of the participants reported wearing hip protectors during the night. To improve effectiveness and compliance, it is important to make the hip protector more comfortable, so that elderly people are also willing to wear it at night. However, the biomechanical effectiveness of the protector should be maintained. In addition, elderly persons and their caregivers should be educated about the importance of wearing the hip protector during the night.

Furthermore, none of the other studies reported whether the hip protector was worn correctly. In this study, 86.7% of the participants wore the hip protector correctly at the first compliance measurement. This percentage increased to 96.5% after 12 months. The remainder was wearing the front side of the underpants backwards or the protectors were damaged. In Dutch nursing homes and homes for the elderly, most clothes are washed in external laundries. Although we asked the nurses to wash the hip protectors themselves, they were sometimes accidentally washed in the external laundry, in which large washing machines and wringers were used, and these can damage the protectors. To improve the correct wearing of hip protectors, the front and backside of the underpants should be better marked, and more attention should be paid to the washing of the hip protector.

This is one of the first large studies in which the determinants of compliance with wearing hip protectors were investigated systematically, followed by statistical analysis of the determinants of compliance. To examine the determinants of compliance, risk ratios were calculated for all persons who were visited during the compliance measurements. Because of the changing study population, e.g. participants who died during the follow-up or stopped wearing hip protectors, the study sample becomes smaller and more selective during the study period. Because of these changes in study population, the results regarding the determinants of compliance should be interpreted per compliance measurement and should not be compared between compliance measurements.

The smaller and more selective study population after 12 months might also possibly explain the fact that fewer determinants were significantly related to compliance at this time point. Furthermore, some variables were difficult to answer for most participants, e.g. ''hip protector visible to others'' and ''fear of falls'', and therefore there were many missing values for these items. Finally, the determinants of compliance which were assessed during the compliance visits should be interpreted with caution, because the interviewer was aware of the outcome (compliant or not) while assessing these potential determinants.

Most determinants of compliance that were statistically significant in univariate analyses appear to be markers for frail nursing home residents who are depending on the nursing staff. The nursing staff dresses most of these people, and therefore the nursing staff plays an important role in the higher compliance in this group. To support the explanation that frail persons are more dependent on the nursing staff, Spearman correlation was calculated between ''being dependent on the nursing staff'' and the three determinants ''type of institution'', ''cognitive impairment'' and ''urinary incontinence'' respectively. The correlation of ''being dependent on the nursing staff'' with ''type of institution'' was 0.526, 0.506 and 0.593 at 1, 6 and 12 months respectively. The correlation of ''being dependent on the nursing staff'' with ''cognitive impairment'' was 0.379, 0.504 and 0.491 respectively, and the correlation with ''urinary incontinence'' was 0.335, 0.495 and 0.504 respectively, supporting the hypothesis that caregivers may play an important role in the compliance of frail elderly persons. For ''urinary incontinence'', an additional explanation might be that persons wearing urinary incontinence materials are more used to wearing special underpants. In one of the homes, a caregiver showed us that in this home exactly the same underpants were used (without protecting shells) to include the diapers for persons who were urinary incontinent. Therefore, these persons were already used to the tight fit of the underpants.

Furthermore, the comfort of the hip protector is an important determinant of compliance. After 12 months, 97% of the persons who were visited indicated that the hip protectors are comfortable. This high percentage can be explained by the fact that persons who did not experience the hip protectors as comfortable stopped wearing hip protectors before this time point, and therefore these persons were no longer visited and thus not included in the analysis. Finally, persons who were compliant at a previous measurement were more likely to continue wearing hip protectors. In the literature, only one prospective study was identified in which statistical tests were performed to analyze the determinants of compliance [18]. In this study, significantly more drop-outs than wearers experienced the hip protectors as uncomfortable; more drop-outs found the hip protector unattractive; and fewer drop-outs thought the hip protector was useful. The first result is similar to our own analyses, in which comfort was an important predictor for compliance.

In multivariate analyses, only two variables were statistically significant. The compliance at 12 months was predicted by the compliance at 1 month. Apparently, people who are still wearing hip protectors after 1 month continue to wear them. Furthermore, persons who had one or more falls in the half year before baseline were less compliant at 6 months. However, it should be noticed that both confidence intervals are close to 1, indicating that it is still very difficult to find independent predictors for compliance, and therefore the results should be interpreted with caution.

In our study, 26 out of 45 persons (57.8%) who stopped wearing hip protectors within 1 month had in fact stopped within 1 week. In another study, 54 out of 101 persons (53% of total hip protector group) stopped wearing hip protectors within 1 week [21]. Therefore, when implementing hip protectors, a try-out period of at least 1 week seems advisable, to predict which people are more likely to adhere in the long-term. Another method to improve bad initial compliance is the use of ''adherence nurses'' [22]. Furthermore, supervision by the regular nursing staff might improve compliance. However, we have no data to confirm this.

The strength of this study is the method of assessing compliance. Compliance in this study was assessed by unannounced visits by a member of the research team. This method was chosen because it is a more objective and valid way to measure compliance with wearing hip protectors. Other methods to assess compliance are telephone interviews and the diary method. A disadvantage of these two methods is that it is not possible to check whether the participant is actually wearing the hip protector. Furthermore, when using the diary method, participants may forget to complete the diary, they may give socially desirable answers and it is possible that compliance is positively influenced by the method.

In future research, more attention should be paid to the role of the nursing staff. In this study, it was observed that it was more difficult in some homes for the elderly and nursing homes to implement hip protectors than in others (data not shown). This may be caused by differences in enthusiasm, workload and other working conditions of the nursing staff. Furthermore, the number of temporary workers may differ between the homes.

In conclusion, compliance is a very important issue in hip protector research and implementation. Although compliance percentages were moderately high during the unannounced visits in this study, not everyone was correctly wearing the protector, and most participants were not wearing the hip protector during the night. As a result of this, the effectiveness of the hip protector in preventing hip fractures will be lower. Therefore, adjustments should be made to the hip protector so that the hip protector is more comfortable to wear and the difference between the front and the back is clearer. Furthermore, it is very important to pay attention to the organization around the hip protector, e.g. the washing

of the hip protector, before implementing the hip protector in an institution.

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